results of these investigations. Cigarettes have been ordered for a third Danchi panel evaluation of the Kanazawa production.

2. **Plans:**

   **JAPAN MARLBORO FACTORY LOCATION CHANGE** Danchi testing of Marlboro KS and Marlboro Lights KS produced in Kanazawa is scheduled for July, 1993.

3. **Conclusions:**

   **JAPAN MARLBORO FACTORY LOCATION CHANGE** JT's modifications to the Kanazawa factory to date are acceptable and meet PM's standards for Marlboro production in Japan. Production will continue to be monitored. Detailed investigations are required to identify factory differences, so that corrective action can be taken.

4. **Contributors:** Hickle, Brumberg, Parrish, Chambers, Matthews, Sherron, JT, PMKK

B. **Strategy:** Marlboro Japan DIET Development Program – Evaluate DIET inclusion in Japan Marlboro family to enhance subjective and analytical performance of the products.

1. **Results:**

   **MARLBORO JAPAN DIET DEVELOPMENT PROGRAM** A third factory trial was completed to evaluate the inclusion of JIET ex PM Ltd. in the Marlboro Japan blend and produce cigarettes for Danchi testing. Two Danchi tests were completed in April, 1993 to evaluate the following cigarettes:

   **Test #1**
   Marlboro KS (current production)
   Marlboro KS (JIET blend/current tar)
   Marlboro Lights KS (current production)
   Marlboro Lights KS (JIET blend/current tar)

   **Test #2**
   Marlboro KS (JIET blend/current tar)
   Marlboro KS (JIET blend/reduced tar)
   Marlboro Lights KS (JIET blend/current tar)
   Marlboro Lights KS (JIET blend/reduced tar)

   Danchi testing was completed and results analyzed. The models with the JIET inclusion blend at current tar were comparable in liking and strength to the current production Marlboro and Marlboro Lights produced in Kanazawa.

2. **Plans:**

   **MARLBORO JAPAN DIET DEVELOPMENT PROGRAM** The JIET inclusion blend is scheduled for implementation in commercial production the week of June 7, 1993. Leaf Department and Export Product Development personnel will be present to monitor the production.

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3. **Conclusions:**

**MARLBORO JAPAN DIET DEVELOPMENT PROGRAM** Consumer testing results support the implementation of the JIET inclusion blend. Monitoring and consumer testing will continue after implementation.

4. **Contributors:** Hickle, Brumberg, Chambers, Parrish, Scott, Shelton, Sherron, PM Ltd. Australia, PMKK, JT

C. **Strategy:** New product launches in Japan to foster growth of PMKK and PM Licensee market share, currently over 11%.

1. **Results:**

**MARLBORO LIGHTS MENTHOL – JAPAN** Negotiations are underway with JT for the licensee production of Marlboro Lights Menthol. The product will deliver 9mg TIOJ tar and is scheduled for launch on November 1, 1993. JT has agreed, in principle, to purchase Marlboro Lights Menthol cut filler and mentholated foil from PM USA in order to meet the scheduled launch date. Technical meetings took place in Tokyo in March and April to discuss the details involved in this program and develop the schedule so that the launch date can be met. It was agreed that the Leaf Department would develop a blend incorporating Japanese tobaccos so that JT can begin primary production in November, 1994. PM USA Engineering personnel have installed a mentholated foil kit on one packer in the Kanazawa factory for production of this brand. Packaging films were delivered to JT by PM USA Purchasing Technical Services. Test specifications have been transferred to JT for the initial factory trial scheduled to take place at the JT's Kanazawa factory the week of June 7, 1993. Marlboro Lights Menthol filler has been shipped to Japan for factory trial production. Base foil specifications have been established and foil delivered to LMCP for mentholation. Two foil mentholation levels will be evaluated in the June, 1993 trials. Information regarding the mode of transportation for mentholated foil from the U.S. to Japan is currently being evaluated.

**VIRGINIA SLIMS MENTHOL 100 FTB – JAPAN** Production of Virginia Slims Menthol 100 FTB began in Louisville in April, 1993. This product will be launched in Japan in July, 1993 and will enable PMKK to gain an additional three years of TV advertising for the brand family.

**NEXT KS FTB – JAPAN** Additional volume requirements were produced in Cabarrus in February, 1993. This product incorporates a PCC filter (carbon on paper core) and has a 1.0mg tar target by TIOJ smoking methodology. This product was designed to achieve a superiority in liking over Frontier Lights among selected ultra low delivery smoker groups. This product was initially planned for test market only, but is now scheduled to be launched nationally in September, 1993.

**LARK ULTRA – JAPAN** Consumer panel testing is planned for June, 1993. This is a 4mg product with a plug space plus filter. The objective is to have a product recommendation by the second quarter, 1994.

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**MERIT ULTRA LIGHTS – JAPAN** A 4.0mg TIOJ tar product was developed using a high efficiency dual carbon on paper/CA filter. This cigarette design using the Mount and Merit Ultima blends was tested on two Danchi consumer panel tests. The Merit Ultima blend achieved parity in liking and strength with Mild Seven Super Lights among Mild Seven Lights smokers. Filters, for the promotional order (60 million), supplied by FIL International Limited, have been manufactured and approved for shipment.

2. Plans:

**MARLBORO LIGHTS MENTHOL – JAPAN** The first factory trial is scheduled to take place in JT's Kanazawa factory the week of June 7, 1993. The menthol on foil level will be determined by July 1, 1993. Production specifications will be transferred to JT in early July, 1993. LMCP commercial production of mentholated foil for JT will begin in July, 1993. A second factory trial using printed materials is scheduled for the week of July 26, 1993. Commercial production start–up is scheduled for the first week in September, 1993 with a product launch date of November 1, 1993.

**VIRGINIA SLIMS MENTHOL 100 FTB – JAPAN** This product will be launched on the Japanese market in July, 1993.

**NEXT KS FTB – JAPAN** NEXT KS FTB will be launched nationally in Japan in early September, 1993. Volume requirements of both 20's and 6's packagings have been received and total approximately 225 million. This production will be monitored subjectively and analytically prior to shipment of product.

**LARK ULTRA – JAPAN** Upon achieving established objectives, subsequent consumer tests will be conducted to replicate the recommended prototype.

**MERIT ULTRA LIGHTS – JAPAN** The objective for the product was achieved; however, the marketplace changes have necessitated a re–evaluation of the program.

3. Conclusions:

**MARLBORO LIGHTS MENTHOL – JAPAN** Negotiations and trials in Japan are proceeding so that a launch date of November 1, 1993 can be achieved.

**VIRGINIA SLIMS MENTHOL 100 FTB – JAPAN** The desired launch date of July, 1993 will be met.

**LARK ULTRA – JAPAN** Future consumer testing will include models with Blend #298 and the Merit Ultima Blend. All Lark Ultra products use the plug space plug filter with Tela paper inner component. The objective remains that this product test at parity to Mild Seven Super Lights among Mild Seven Lights smokers.

**MERIT ULTRA LIGHTS – JAPAN** The Merit Ultra Lights national launch is delayed and a repositioning of the current Merit Lights product from 6mg to 4mg TIOJ tar is planned.

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4. **Contributors:** Hickle, Lambert, Sealey, Tierney, Brumberg, Claflin, Finley, Foster, Laslie, Mathisen, Matthews, Newman, Parrish, Patron, Pflueger, Shelton, LMCP, QE, PMKK, PM Asia, JT

D. **Strategy:** New product launches in Asia, EEMA and EEC to increase market share in existing markets and establish sales in markets previously restricted to importation.

1. **Results:**

**PAN ASIAN MENTHOL** Hong Kong Consumer Panel test E–7844 was produced in Semiworks the week of April 12, 1993. The following models will be evaluated in this test:

Australian Alpine filler model
Blend T–508 with a/c 8570–49–1
Blend T–508 with a/c 8570–49–2
Blend T–508 with a/c 8570–49–3

Tar deliveries for these models are targeted at 8mg UK method. Smoke menthol deliveries are targeted between 0.25mg and 0.35mg. Fieldwork is scheduled for June, 1993 with results available in July, 1993.

**CALIFORNIA – GCC** Prototypes for full flavor (ISO tar 9mg/nicotine 0.7mg) and lights (ISO tar 7.0mg/nicotine 0.5mg) products are being developed to compete against Gold Coast and Viceroy in Saudi Arabia. RJR and B&W have recently reduced the price of both brands which moved these products from the "low" price segment to the "cheap" price segment. California full flavor and lights will compete in the "cheap" price segment (15 Saudi riyals/carton).

**MERIT LIGHTS – KOREA** Results received from SCP testing indicate that the carbon on tow filter system with the PMSL Blend – Ring A+ flavor system at 5.0mg FTC exhibited an improvement in both strength and liking compared to the present 3.0mg Merit Lights product. Additional testing with exotic A/C flavor systems is planned for early June, 1993 with fieldwork results expected in late July, 1993.

**ADDITIONAL PRODUCT LAUNCHES**

Marlboro 100's FTB Red for Taiwan – Launched in April, 1993.

Marlboro KS SP in 1/2 Carton for U.S. Duty Free Sales – Launched in April, 1993.

Marlboro Lights KS SP in 1/2 Carton for U.S. Duty Free Sales – Launched in April, 1993.

Merit KS Menthol FTB for Puerto Rico and General Export – Launched in April, 1993.

Marlboro KS SP for Laos and General Export – Launched in April, 1993.

Marlboro KS FTB for Brunei – Launched in May, 1993.

L&M KS FTB for Canary Islands – Launched in May, 1993.

B&H 100's Regular and Menthol FTB and Marlboro Lights 100's FTB for Puerto Rico – Launched in April, 1993.

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2. **Plans:**

**PAN ASIAN MENTHOL** Results of HKCP–M E–7844 will be available in July, 1993. A second test is planned to incorporate the most promising models from E–7844, Salem Lights and Marlboro Lights Menthol.

**CALIFORNIA – GCC** Brica IV blend will be processed with two flavor systems, made to full flavor and lights configurations and submitted to CTSD for analyses. Subjective evaluation/approval will be conducted by the Richmond Panel and EEMA personnel. Prototypes will be available for the CPC meeting scheduled for 5/24/93.

**MERIT LIGHTS – KOREA** Evaluate consumer testing and recommend product modification to improve market share increase performance of Merit Lights – Korea.

**ADDITIONAL PRODUCT LAUNCHES**

Marlboro 100's FTB Singapore – for launch 4th Quarter, 1993.

Marlboro Lights KS FTB – PRC – for launch 4th Quarter, 1993.

Marlboro Lights 100's SP (Reduced Tar) – Korea – Relaunch 1st Quarter, 1994.

Marlboro Medium KS SP/FTB Hong Kong – for launch 3rd Quarter, 1993.

Merit Lights KS FTB Hong Kong – for launch 3rd Quarter, 1993.

Virginia Product (Hilda) Taiwan – for launch 3rd Quarter, 1993.

Philip Morris Menthol KS FTB GCC – To be determined.

Marlboro KS FTB Taiwan – for launch in June, 1993.

Marlboro Lights KS FTB (Remington Wooden Box) Hong Kong Duty Free – for launch in June, 1993.

Marlboro Lights KS FTB (5 Carton Tote) Hong Kong Duty Free – for launch in June, 1993.

Parliament FF and LIghts FTB Rounded Corner Pack Japan – for launch in December, 1993.

3. **Conclusions:**

**PAN ASIAN MENTHOL** HKCP Menthol testing to date has not identified a prototype suitable for this program. The Australian Alpine blend and Blend T–508 will be consumer tested in Hong Kong in June. Additional testing of Blend T–508 will be completed in 1993. A launch date has not been determined for this product.

**CALIFORNIA – GCC** The California full flavor and lights national launch is scheduled for August, 1993.

**MERIT LIGHTS – KOREA** Evaluate consumer testing with Hong Kong and Korean operations personnel and determine relaunch strategy. Initiate product specifications and monitor product start–up prior to shipment.

4. **Contributors:** Easley, Hickle, Sealey, Tierney, Chambers, Jackson, Matthews, Parrish, Scott, Shelton, Leaf Department, Semiworks, PM Asia, EEMA, EEC



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|---|---|---|
| **PROGRAM NAME** | : | International Product Development – Export – Operations Driven |
| **PROGRAM COORD.** | : | J. N. Smith |
| **WRITTEN BY** | : | J. Easley, J. Hickle, R. Lambert, D. Sealey, and B. Tierney |
| **PERIOD COVERED** | : | Second Quarter, 1993 |

**Coordinator Summary:** Consumer testing is underway to determine moisture specification for PM specification coconut carbon. Upon determination of the moisture specification, machinability trials will resume.

All Lark products with plug space plug filters have been converted to the Kimberly–Clark porous heatseal combining wrap during April, 1993.

All Parliament filter specifications were modified during April, 1993 to include a more efficient inner filter for the entire Parliament brand family.

Trials are being conducted in Cabarrus with the dual hopper max process. Upon achieving acceptable subjective and analytical results, qualification of this machinery will begin.

NET product is to be evaluated in the Parliament blend on Danchi Panel during June, 1993.

**I. Objective:** Provide support to operations with respect to existing export products in the areas of quality, cost/productivity, capacity, and environmental compliance.

**A. Strategy:** Filter optimization improvement to existing filtration mechanisms for the purpose of reduction of product variability, cost reduction, consolidation of material specifications and productivity improvement. Development in this area is focused on carbon consolidation, porous combining wrap, Parliament filter optimization, and the dual hopper max process.

**1. Results:**

CARBON CONSOLIDATION

**Coconut Based.** 20 x 70 sized material will be evaluated with the increased efficiency inner filter for Parliament upon determination of moisture level for this product.

**Coal Based.** A long term agreement to purchased PMCC carbon without iron and zinc impregnants was made. This agreement will result in annual savings of $1.1 million.

**POROUS COMBINING WRAP** Lark Super Lights and Lark GCC products have been converted to the Kimberly–Clark porous combining wrap during April, 1993. This completes the conversion from the Ecusta mechanically perforated combining wrap.

**PARLIAMENT FILTER OPTIMIZATION** All Parliament inner components have changed tow item from 5.0x35,000 to 2.7x35,000. This will provide a more efficient system for these products. This was completed during April, 1993.

**DUAL HOPPER MAX** A maker is currently set up for this operation in Cabarrus. Components are fed directly to the tipping process eliminating the need for the off–line combining process.

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The significant modifications required for dual hopper max versus the current product are filter component length change, ventilation hole relocation, an opaque plug wrap for the inner component, and vendor modification to tipping paper.

**NET INCLUSION** A Danchi panel will be conducted during June which NET product will be included in the Parliament blend at a rate of 15%.

2. **Plans:**

**CARBON CONSOLIDATION**

**Coconut Based.** Inventories of MF2C carbon are being held to a minimum in order for a quick and orderly change to PM specification coconut carbon, to be completed upon resolution of final specification.

**Coal Based.** PMCC carbon will continue to be purchased from Calgon for cavity filters until December, 1995. Further consolidation efforts will be evaluated during this period.

**DUAL HOPPER MAX** Trials are being conducted with the newly designed product. Upon successful quality, subjective, and analytical product performance, final specifications can be issued for start–up.

**NET INCLUSION** A second test is scheduled for consumer testing in July to replicate the 15% NET inclusion with the Parliament blend.

3. **Conclusions:**

**CARBON CONSOLIDATION** Due to recent pricing information, 18% moisturized carbon has an increased cost over 3% moisturization. A Danchi test to be conducted during June will determine if the 18% moisturized carbon is essential to maintain product attributes.

**POROUS COMBINING WRAP** Completed converted to the Kimberly–Clark material during April, 1993. Kimberly–Clark porous heatseal combining wrap is now specified for all Lark plug space plug filters.

**PARLIAMENT FILTER OPTIMIZATION** All specifications modified April, 1993.

**DUAL HOPPER MAX** Factory start–up planned after achievement of acceptable product, subjective, and analytical results.

**NET INCLUSION** If all consumer testing is successful, NET product inclusion is planned for 1994.

4. **Contributors:** Lambert, Sealey, Finley, Laslie, Parrish, Matthews, Manufacturing Services, QA, QE, Engineering, Manufacturing

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| **PROGRAM NAME** | : | International Product Dev. – Lic. & Aff. – Marketplace Driven |
| **PROGRAM COORD.** | : | J. N. Smith |
| **WRITTEN BY** | : | G. Haskins, R. Tinker |
| **PERIOD COVERED** | : | Second Quarter, 1993 |

**Coordinator Summary:** During this reporting period, prototypes for L&M Lights and L&M Full Flavor were produced in Costa Rica using new blends recommended by the Richmond Leaf Department. Product launch for L&M Lights or L&M Full Flavor or both is tentatively planned for third quarter, 1993.

In Mexico, product development work continues on B&H 100's Lights FTB and Parliament Full Flavor KS FTB using U.S. sourced NTM's and casing/flavors.

**I. Objective:** To support the growth of international business through the launch of new commercial products for licensee and affiliate markets in Asia, EEMA, EEC, and LA/I.

**A. Strategy:**

**1. Results:**

**B&H Lights 100's FTB (Mexico)** Prototypes were produced in Mexico City using U.S. sourced tipping paper, cigarette paper, and plug wrap. C.I.'s have been completed on this prototype (P–563).

**L&M Lights/L&M Full Flavor (Costa Rica)** Blend NB–1 #2 was recommended by the Richmond Leaf Department and prototypes were produced in Costa Rica the week of April 26, 1993.

**Parliament KS FTB (Mexico)** NTM's, including filter rods, have been shipped to Mexico from the U.S. for prototype production.

**Marlboro Lights Menthol (Mexico)** Prototype with current blend was approved by Richmond.

**2. Plans:**

**B&H Lights 100's FTB (Mexico)** Because FTC tar on prototypes (P–563) is about a half milligram low, plans are to do a C.I. to recheck before making cigarette construction modifications.

**L&M Lights/L&M Full Flavor (Costa Rica)** C.I.'s are pending. Subjective evaluations will be conducted by the Leaf Department, the International Brands Panel, and the Richmond Panel. Tentative product launch is scheduled for the third quarter, 1993.

**Parliament KS FTB (Mexico)** Prototypes will be produced in Mexico City using U.S. supplied NTM's, U.S. casing/flavor systems, and standard Mexican Marlboro blend in June or July, 1993.

**Marlboro Lights Menthol (Mexico)** Marlboro Lights Menthol launch date has been rescheduled for late second quarter or early third quarter, 1993.

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**PROGRAM NAME** : International Product Dev. – Lic. & Aff. – Operations Driven
**PROGRAM COORD.** : J. N. Smith
**WRITTEN BY** : G. Haskins, R. Tinker
**PERIOD COVERED** : Second Quarter, 1993

**Coordinator Summary:** Our operations driven product development work during this period focused primarily on Marlboro improvement programs in various countries.

We are also into the long–term project of compiling cigarette, processing, and NTM specification for corporate brands produced by affiliates and licensees. We are reviewing cigarette specifications for uniformity and conformity to U.S.A. standards.

**I. Objective:** To provide support to operations with respect to existing licensee and affiliate products in the areas of quality, cost/productivity, capacity, and environmental compliance.

**A. Strategy:**

**1. Results:**

MARLBORO

**Dominican Republic.** Oriental tobacco has been shipped to the Dominican Republic from country of origin and formula abstracts have been prepared for two (2) prototypes.

**Mexico.** Cigatam has completed an extended consumer test on the Marlboro with U.S. sourced ingredients. P.M.I. is reviewing results of the test and methodology used before deciding if this test needs to be repeated.

**Argentina.** Subjective results were inconclusive on corporate brands (L&M, Chesterfield, B&H, and Parliament). International Product Development Licensees and Affiliates management decided to discontinue any further work on this project. Prototypes utilized current blends with substitute licorice.

**Venezuela.** A meeting was held in Venezuela the week of May 15, 1993, and a decision was made to discontinue the oriental tobacco inclusion and non–carbon filter evaluations for Marlboro.

**Costa Rica.** Tipping paper trials on Marlboro Full Flavor using 18cm pressure drop tipping paper, which delivers 13% ventilation has been completed and implemented.

**2. Plans:**

MARLBORO

**Dominican Republic.** Factory trials have been tentatively scheduled for mid–June, 1993 to prepare Marlboro Full Flavor prototypes with oriental tobacco inclusion at 10% and 5% levels.

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**Mexico.** Marlboro, with U.S. sourced ingredients, may have to be remade — waiting for decision from P.M.I.

**Argentina.** There are no immediate plans to continue the substitute licorice evaluations. Project discontinued.

**Venezuela.** Activities on the oriental tobacco inclusion and non–carbon filter for Marlboro Venezuela has been discontinued.

**Costa Rica.** Future trials are planned for 1993 to standardize Marlboro, casings, and flavors.

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| **PROGRAM NAME** | : | R&D Product Technologies – Paper Technology |
| **PROGRAM COORD.** | : | S. Baldwin |
| **WRITTEN BY** | : | S. Baldwin and G. Bokelman |
| **PERIOD COVERED** | : | Second Quarter, 1993 |

**Coordinator Summary:**

**Banded Papers:** Limited slurry trials were conducted at Kimberly–Clark's Spotswood mill using the moving orifice device. Capacitor paper slurries at different consistencies were evaluated during one to two minute runs off–line at the Kimberly–Clark mill. Instead of a conveyor belt beneath the MOD, a wire and vacuum box were constructed to simulate a paper machine. Band width, band definition, spacing and drainage were assessed. Runnability is better at lower slurry consistency, but band definition suffers. Extended runnability trials are planned for June. Refining trials for aspen and other hardwoods are also planned for June. Uniformity of application within the band will also be assessed for the capacitor paper and hardwood slurries.

Gravure printing trials were conducted at Kimberly–Clark's Munising mill. The banded papers were manufactured at speeds of up to 1000 fpm with good band definition. Progress was made toward addressing the problem of wrinkling, but further process development will be necessary.

All response surface papers have been printed in–house using the Fox Valley Coater.

**Wood Pulp Papers:** Cigarettes prepared from papers containing 75% flax and 25% hardwood fibers and 85% flax with 15% hardwood were evaluated subjectively by internal panels. The models containing 25% hardwood fiber in the paper were evaluated by the Richmond Panel and judged to be different from the flax control. Further evaluation of cigarettes with the 15% wood paper is in progress.

Pricing information on papers containing wood/flax blends was obtained from Kimberly–Clark through the Purchasing Department. Savings on a 25% hardwood paper would be about $0.55 per bobbin. For the 15% hardwood paper, savings would be about $0.33 per bobbin. Kimberly–Clark also lacks adequate blending capacity at present to produce these papers on a routine basis. Considerable capital investment would be required to do so.

**Cigarette Paper Consolidation:** In light of the current partnering agreement with Kimberly–Clark, new cost estimates were obtained from K–C through the Purchasing Department for three and four paper grades to replace the existing seven grades of cigarette paper. No cost savings could be obtained with three or four papers, but there may be unquantifiable benefits in terms of inventory management. Cost estimates for three and four papers were about 2% higher than for our existing papers. A paper designed as a lower cost replacement for the 10–078A paper was also about 2% higher in cost than the current paper. Additional information has been requested.

**Cigarette Paper Specifications:** Paper specifications have been forwarded to Purchasing to define the calcium carbonate target and tolerances as critical paper parameters. A chalk target of 29.5% ± 3.5% has been proposed. K–C's Spotswood mill had determined that it could comfortably operate at 29% ± 4% calcium carbonate without further capital investment. KC research personnel have agreed that the proposed target and tolerances should be attainable.

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**Reduced Sidestream:** A low sidestream paper produced to support the Merit Low Sidestream Product Development work was found to give unacceptably long static burn times for some full circumference products. Another paper was made at slightly higher permeability. The lower permeability paper gave about 50% visibility reduction for the full circumference product. The new paper should give a more acceptable static burn time.

The use of hardwood fibers in low sidestream papers appears to yield improved sidestream reduction compared to flax. Such fibers could also reduce the price of low sidestream papers.

Calendering low sidestream papers was also shown to enhance sidestream reduction without producing unacceptable static burn times. Confidentiality agreements are being negotiated with Kimberly–Clark for further development of calendared low sidestream papers and hardwood fiber papers.

I. **Objective:** Develop procedures for the application of transverse bands to cigarette paper in order to control burn rate in 1993.

A. **Strategy:** Develop the capability to apply cellulosic bands during the papermaking process using the Moving Orifice Device.

1. **Results and Conclusions:** The conclusion from MOD trials conducted on–line in the first quarter at K–C's Spotswood mill was that a different slurry with better drainage characteristics needs to be developed for MOD application. A number of problems were encountered with the Avicel slurry at the press section of the paper machine. Avicel had never been evaluated on a paper machine prior to these trials. Experiments are being conducted with experimental slurries in attempts to achieve the drainage characteristics of more conventional papermaking slurries such as those which had previously been under consideration. Aspen was previously the fiber of choice.

   Other alternative materials are being evaluated for MOD such as capacitor paper fiber and refined eucalyptus. K–C has modified the PM constructed off–line MOD assembly to better simulate a paper machine wire. Initial trials on this off–line MOD assembly to evaluate alternative slurries were conducted. The permeability versus application level relationship for refined cellulose slurries depends largely upon the degree of refining of the pulp. Band definition with refined cellulose slurries is not as good as with the Avicel materials due to the coarser nature of the refined pulps. The processability of these cellulosic slurries through the MOD will be determined during an extended runnability trial prior to conducting further mill trials.

2. **Plans:** Continue the off–line evaluations of refined cellulosic slurries. Conduct a mill trial when a slurry is developed that gives acceptable band definition, uniformity, and runnability.

3. **Contributors:** N. Gautam, H. Lanzillotti.

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B. **Strategy:** Investigate the application of bands of cellulosic materials to cigarette paper using printing techniques.

1. **Results and Conclusions:** Scale–up trials for gravure printing were conducted at Kimberly–Clark's (K–C) Munising mill. The banded papers were manufactured at up to 1000 fpm with good band definition. More work needs to be done to eliminate wrinkles. K–C is evaluating several methods to re–wet the banded wrapper prior to drying bands.

   Gravure printing of Avicel bands on cigarette papers for the response surface study was completed, and cigarettes are in the process of being selected for weight and band position before being submitted for testing. Band spacing was designed to provide one band per cigarette.

2. **Plans:** Continue working with K–C to develop gravure printed banded wrappers in commercial quantities. Evaluate approaches to eliminate wrinkles from gravure–printed banded wrappers. Papers printed with multiple gravure bands on the Fox Valley coater will be compared to similar papers produced at K–C.

3. **Contributors:** Paper Technology, Filter Technology (G. Patron), Product Research (D. McRae), Analytical Research (V. Baliga), Development Engineering (A. Burton).

C. **Strategy:** Develop analytical methods to measure the properties of banding materials and banded papers.

1. **Results and Conclusions:** Additional calibration testing has confirmed that the absorption coefficient for the Ambertec beta formation tester, as expected, is stable over time. The absorption coefficient is a critical parameter in calculating the basis weight differential in the banded region of banded papers.

   A review of potential sample inspection procedures for banded papers has been initiated.

   Working with DCS Corporation and Kimberly–Clark, an optical detector that can operate in two different modes (fast and slow) is being investigated. In the slow, or manual, mode it would be used to measure band width and spacing between bands. It also will identify and mark the positions of the bands. In the fast, or automated, mode, it would be used to inspect an entire bobbin of paper to see if any bands are missing. As a laboratory unit, the optical detector could be mounted on a modified electric spark perforator unit for possible use by Incoming Materials on an audit basis.

   At this time, a thermal approach to measure paper permeability, as originally suggested by the DCS Corporation, does not appear to be feasible. However, preliminary discussions with Development Engineering have indicated that it may be possible to significantly shorten the permeability measurement time for banded papers by upgrading an existing conventional instrument (Greiner or PPM 100) to measure actual flow at a constant pressure differential. A formal request for development of an upgraded, manual instrument has been submitted.



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2. **Plans:** Proceed with the DCS Corporation and Kimberly–Clark to assess an automated optical inspection system which could be used to monitor the on–line production of banded paper. Work will continue to define the essential material requirements for slurries, in collaboration with Kimberly–Clark. Critical parameters for the slurries will be measured using a Cahn balance (model DCA 322), including dynamic contact angle, surface energy, and wicking rate. Viscosity and purity requirements will also be defined for each slurry material.

3. **Contributors:** Paper Technology (G. Bokelman, W. Geiszler), QA Standardization (R. Gilman, T. Fletcher), Development Engineering (N. Nunnally).

**II. Objective:** Evaluate the feasibility of replacing flax papers with wood pulp papers for full margin brands and develop the appropriate papers.

**A. Strategy:** Evaluate wood/flax blend papers on full margin prototypes.

1. **Results and Conclusions:** Flavor Panel testing was conducted for Marlboro KS models made with two flax/wood blend papers and a flax control paper. Based on Flavor Panel findings, a model with a 75/25 flax/wood paper was submitted to the Richmond Panel for evaluation versus the flax control cigarette. Price estimates submitted to Purchasing by Kimberly–Clark show a small cost benefit for a 25% wood paper of $.55 per bobbin. The 15% wood paper would save about $.33 per bobbin. At present, however, Kimberly–Clark does not have adequate blending capabilities to handle wood/flax blends for all production papers.

2. **Plans:** Subjectively evaluate cigarette prepared with papers containing 15% hardwood, 85% flax. Conduct consumer test as required.

3. **Contributors:** W. Geiszler, M. White, H. Maxwell.

**B. Strategy:** Investigate pulps and papers prepared from alternative pulping and bleaching processes.

1. **Results and Conclusions:** Analyses were conducted by two outside labs for levels of sulfur and chlorine in several pulp samples. Sulfur values from one lab were 30–40% lower than from the other lab, but were in the same relative order. Chlorine values were similar from both labs. The same samples are being used by Analytical Research to evaluate an X–ray fluorescence procedure for determining sulfur and chlorine levels in pulps.

   Tandem mass spectral studies of wood and flax pulps and papers have been initiated. Results are quite preliminary but are very encouraging.

2. **Plans:** Complete experiments involving tandem mass spectral studies of wood and flax pulps. A confidentiality agreement will be executed with Kimberly–Clark for detailed review of pulping and bleaching conditions for wood versus flax.

3. **Contributors:** Paper Technology (W. Geiszler, G. Bokelman), Analytical Research (N. Jensen, D. Miser, K. Torrence).

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**III. Objective:** Determine those cigarette paper parameters which most affect cigarette performance and set optimized specifications and tolerances for cigarette papers.

**A. Strategy:** Evaluate the effects of paper properties on cigarette performance attributes (puff count, tar, static burn time, etc.) in order to determine whether tolerances on paper specifications are appropriate for full flavor and low delivery cigarettes.

1. **Results and Conclusions:** The evaluation of the effect of cigarette paper parameters on cigarette performance is complete. The calcium carbonate content of the paper has been shown to be a critical factor in determining tar delivery and control. Permeability is also a critical factor, but its effect is diminished in the higher Coresta ranges.

   Recommendations for calcium carbonate specifications for all standard grades of cigarette papers have been made. The recommended calcium carbonate pallet average target for all standard grades (except 10–078–A) is 29.5% ± 3.5%. The recommended calcium carbonate pallet average specification for 10–078–A remains as is, 36.5% ± 3.0%. In addition, to minimize sample variation, a calcium carbonate target for all individual analytical measurements is proposed as 29.5% ± 5.0% for all standard grades except 10–78–A. For that paper, the recommended target for individual measurements is 36.5% +3.0%/–5.5%. An alternative approach is to specify a standard deviation for the pallet.

   Recommendations for permeability uniformity have also been proposed. It is recommended that the specifications for permeability pallet averages remain as currently written. It is recommended that, for *individual* permeability measurements, the range for pallet averages be broadened by 2 Coresta units from the current specifications for pallet averages. These recommendations will be reviewed with Kimberly–Clark manufacturing personnel in early June.

   Discussions with Kimberly–Clark indicate that they should be able to operate at a calcium carbonate target of 29.5% using existing refining capabilities.

2. **Plans:** Implement specification changes through the Purchasing and Technical Services Departments. Evaluate pallet uniformity proposals with internal Philip Morris stakeholders. Continue discussions with Kimberly–Clark.

3. **Contributors:** Paper Technology (S. Baldwin, B. Floyd, W. Geiszler).

**B. Strategy:** Evaluate the feasibility of consolidating the seven paper grades currently being used (excluding Superslims) to four or fewer grades.

1. **Results and Conclusions:** Paper specifications to yield increments of 0.7 mg in FTC tar delivery between four paper grades for a full flavor cigarette were designed from the response surface model. Price estimates were received from Kimberly–Clark for the four specified grades. Estimates were also provided for a scenario involving only three paper grades; it showed no cost advantage over the four–grade scenario. K–C estimates for papers with 29.5% ± 3.5% chalk were about 2% higher than prices for our current papers. A redesign of the 10–078–A paper intended to reduce cost was also estimated by K–C to be about 2% more costly than the current grade.

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Full flavor, lights, and ultra lights cigarette designs were made with a set of five papers produced at specific target values of permeability, calcium carbonate content, basis weight, and citrate level. Analytical smoking results for the lights models show satisfactory agreement with the response surface model from which the paper designs were selected. Smoking analyses are being completed for the other two delivery levels.

2. **Plans:** Analytical smoking determinations for full flavor and ultra lights models made with the specified papers will be completed. Cost estimates will be reviewed with K–C. A recommendation regarding implementation of new paper grades will be reviewed internally and with Kimberly–Clark.

3. **Contributors:** Paper Technology (W. Geiszler, B. Floyd).

IV. **Objective:** Develop a proprietary cigarette wrapper which will reduce visible sidestream smoke in a full circumference cigarette by 50%, compared to an appropriate control, while maintaining subjective parity.

A. **Strategy:** Develop calcium carbonate papers suitable for use with potential commercial reduced sidestream products.

1. **Results and Conclusions:** Paper parameters of the modified low sidestream paper produced by Kimberly–Clark (grade 016) earlier this year include a basis weight of 43–44 g/m$^2$, 4–5 Coresta, 29–30% Multifex MM calcium carbonate, and 12.5–12.8% MKP. The main differences from the 41–42 g/m$^2$ grade 049 paper used for consumer testing last year are a lower porosity and higher MKP additive level. Sidestream visibility comparisons were made among these two papers and the 53 g/m$^2$ Superslims paper on 24.0x100mm cigarette models. Sidestream reductions were 54% for the new grade 016 paper, 51% for the Superslims paper, and 37–41% for the grade 049 paper. The static burn time for the new paper, however, was longer than desired.

   The three different low sidestream papers were coated with CR–2978 and were utilized by the low sidestream team for sets of cigarettes made to Merit, Merit Ultra Lights, and Marlboro Ultra Lights specifications. Sidestream visibility analyses were obtained on these cigarettes and showed the same trends in each set. The new grade 016 paper and the Superslims paper gave about 50% visibility reduction, while the grade 049 paper gave about 35% reduction. As observed in the initial set of cigarettes, the new grade 016 paper produced unacceptably long static burn times. Another paper has been requested from Kimberly–Clark with slightly modified specifications to reduce the static burn time without compromising visibility reduction.

   The coating of low sidestream calcium carbonate MKP paper with CR–2978 was completed. Cigarette models made from this paper will be subjected to additional analytical testing to support final phase clearance of this additive on low sidestream paper.





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The preliminary examination of the three papers for export models for Japan was also conducted. Sidestream visibility reductions and static burn times showed the same trends as the domestic models.

Polyisopropenyl acetate (CR–2612, an acetic acid release compound) was applied to the three low sidestream papers (4–5% target). Coresta permeabilities decreased by about 25% after coating. ARD analyses of the samples indicated about 5–6% CR–2612 on the papers.

2. **Plans:** A modified low sidestream paper for domestic and international product development will be produced and tested. The application of CR–2612 and CR–2978 on low sidestream papers will be supported.

3. **Contributors:** Paper Technology (B. Goodman, S. Tafur, N. Gautam, B. Floyd), Flavor Technology (T. Cravotta), Product Research (W. Edwards), Analytical Research.

B. **Strategy:** Explore alternative approaches for enhancing sidestream reduction, such as the use of hardwood papers and calendering.

1. **Results and Conclusions:** Two flax low sidestream papers with basis weights of 41 g/m$^2$ and 53 g/m$^2$ were hot calendered in–house and used to prepare machine–made cigarettes. The cigarettes showed enhanced sidestream reduction. It appears that calendering offers important advantages by providing excellent sidestream reductions at low basis weights and low levels of paper additives (sizing). An invention disclosure on calendering was prepared and a patent application is now being prepared for filing.

   Evaluations were conducted on a 44 g/m$^2$ eucalyptus low sidestream paper (4–5 Coresta) previously prepared at the University of Maine. Based on machine–made cigarette analyses, the eucalyptus paper appears to provide greater sidestream reduction than comparable flax papers. Handmade cigarettes prepared from handsheets had previously yielded similar results. Eucalyptus low sidestream papers also offer potential savings versus flax low sidestream papers due to lower fiber costs and reduced paper basis weights. An invention disclosure covering the use of hardwood fibers in low sidestream papers was prepared.

2. **Plans:** Prior to ordering a mill run of eucalyptus low sidestream paper, a confidentiality agreement will be negotiated with Kimberly–Clark. The feasibility of replacing current Superslims paper with eucalyptus paper, in order to reduce costs, will be evaluated. The potential of other hard wood fibers, such as aspen, for sidestream reduction will also be evaluated. A confidentiality agreement on calendering will be negotiated with Kimberly–Clark. The effect of calendering on the eucalyptus low sidestream paper will be evaluated.

3. **Contributors:** Paper Technology (N. Gautam, B. Goodman).

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**V. Objective:** Develop a modified polysaccharide incorporating a covalently bound flavorant for incorporation into the wet end of the papermaking process so the flavorant will be thermally released when a cigarette is smoked.

**A. Strategy:** Develop vanillin–cellulose derivatives for evaluation.

1. **Results and Conclusions:** Paper handsheets were prepared with three different cellulose derivatives at a target of 4% incorporation. The test materials included a propylene glycol acetal vanillin derivative of wood pulp, a hydrolyzed sample of the PG acetal derivative, and a newly prepared sample of the unprotected vanillin glycidyl ether of wood pulp made with a purified intermediate. Evaluation of the sidestream from handmade cigarettes prepared with the paper handsheets indicated more detectable aroma from paper with the PG acetal than the other two samples. Pyrolysis GC/MS of the papers showed significantly more vanillin released from the paper with the PG acetal. Solid–state $^{13}C$–NMR of the papers could detect aromatic resonances corresponding to the vanillin moiety in the PG acetal sample, but not from the hydrolyzed sample. These analytical results were consistent with observations from pyrolysis GC/MS analyses of the neat materials. They also indicated better incorporation of the PG acetal derivative in the paper handsheet.

   Additional investigation of the reaction chemistry by Aqualon has suggested that pH of the work–up has caused the formation of an internal acetal by the free vanillin aldehyde, rather than its oxidation. Evidence to date also indicates that the vanillin glycidyl ether must be in the form of a free aldehyde in order to obtain vanillin release upon pyrolysis.

2. **Plans:** For the near term, no additional work is planned on the hydrolysis of the PG acetal derivative. The PG acetal material will be recommended to the Flavor Committee to obtain phase I clearance prior to scaled–up production of material for papermaking at the University of Maine.

3. **Contributors:** Product Research (G. Chan), Analytical Research (J. Wooten, J. Naworal), Paper Technology (S. Tafur, N. Gautam).

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| **PROGRAM NAME** | : | R&D Product Technologies – Filter Technology |
| **PROGRAM COORD.** | : | K. Newman |
| **WRITTEN BY** | : | K. Newman/J. Hearn |
| **PERIOD COVERED** | : | Second Quarter, 1993 |

**Coordinator Summary:** In the area of fiber technologies to address lighter weight filters, selective filtration and/or degradability, development of crimping technology for Tencel fiber was addressed by Courtaulds UK. Preliminary samples of wet and dry crimped Tencel tow were provided for PM evaluation. Computer designs of Lights and Ultra Lights products were utilized to predict tow weight savings opportunities by moving the vent rows toward the tobacco column. The family of PM discount products was used to prepare a cost savings analysis. Tow cost savings on the various Lights and Ultra Lights KS and 100's specifications can range from 2 to 8%.

In the area of High Efficiency Carbon Filters/Low DPF Tow, capability evaluations of Eastman's 1.2/30,000 and 1.2/35,000 with and without PICA RC 328 carbon additive were conducted. Eastman was requested to provide samples of 1.4/35,000 and 1.4/41,000 materials. One bale of each was received and filter samples with carbon were made to Merit Ultra Lights – Japan (4mg) specifications. With regard to Heterofil and Alternative Fiber Development with Hoechst Celanese, researchers at Hoechst Celanese recalculated data from earlier selective filtration screening studies. This eliminated systematic errors encountered when water analyses were used to calculate the gram amount of organics present. Sixteen polymers were tested at this point in the program. Finally, tow cost savings proposals were solicited from Eastman by PM Purchasing. Eastman's proposal entails the conversion of the major filter tow materials currently used by PM to three new tow items: 3.5/30,000, 2.7/30,000, and 2.0/32,000. Filter Technology will continue to be an active participant in the Filter Optimization Program by monitoring tow capability data, providing physical testing, and providing direction related to appropriate brands for implementation of this program.

In the area of web technology development, a series of ten hydroentangled Tencel webs was produced on DuPont's "Sontara" process under various process conditions to maximize filtration efficiency performance. Rodmaking trials and filter testing were performed on each web. One model, a wet laid Tencel paper phase laminated to the hydroentangled web, exhibited the highest filtration efficiency (~4% higher than Tela paper). Also, Kimberly–Clark was asked to evaluate the plugwrap requirements for the VAMP high speed combiner. Kimberly–Clark will perform basic investigations to analyze paper and hot melt components of the wrapper. Further, at the request of Operations Services, PM Purchasing department requested Kimberly–Clark to provide PM with plug wrap materials with targeted porosity between current 45M1 and 260M4T. Plug wrap materials with porosities in the 9500 to 14000 Coresta range should meet the design criteria.

In the area of novel filters, PCC filters without core plugwrap were supplied by AFC for comparison testing against the standard Merit Ultima PCC filter. Control and test cigarettes produced in Semiworks exhibited comparable analytical performance with unventilated filtration efficiency in each case measuring 70%. Also, two filter specifications were prepared to examine the performance of the MBF low RTD/high efficiency mono acetate filter system, which was designed to deliver ~11mg tar at 0% ventilation. Samples were ordered for product testing.

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In support of product initiatives, a carbon on paper/cellulose acetate dual filter made by Filtrona International Limited (FIL) has been tested and is being purchased for Merit 4mg – Japan. Specifications were supplied to American Filtrona and Baumgartner to evaluate their carbon on paper processes. Concurrently, models with carbon on tow/cellulose acetate dual filters are undergoing comparison testing against the Filtrona International Limited filter. Also, filter specifications were prepared and issued to Baumgartner for sample production of paper–carbon–acetate plug–space–plug filters for Lark Ultra Lights 4mg. These filters were received, tested, and used to produce cigarettes for consumer testing. Filter Technology also participated in Pin Perforation System (PPS) development by providing technical resources for the evaluation of ventilation and RTD data from Parliament filters produced on prototype PPS equipment. Extended testing of a production PPS machine was conducted in May. Filters were collected for aging testing (warehouse and accelerated conditions) and for determination of perforation/tipping paper interactions.

In the area of computer modelling support, seven Lark Mild cigarette models were produced in Semiworks. Puff by puff gas phase analyses were performed on cigarettes smoked in vertical and in horizontal positions. Cigarettes were selected to an RTD and ventilation targets. Data from CTSD and vertical and horizontal RTD measurements were used by Physical Research to calculate carbon adsorption and related values used in the computer models.

Finally, Filter Technology participated as an R&D representative on the Engineering Packaging Innovation Team. Currently two packaging studies are scheduled; the Aluminum Pack study (Aug. 23), and the Booklet Pack study (June 15). Aluminum packs with and without all white graphics were completed. Packs for the Booklet study are currently being hand assembled.

**I. Objective:** Identify, develop, and apply relevant fiber technologies to address lighter weight filters, selective filtration and/or degradability.

**A. Strategy:** Evaluate Tencel spun cellulose tow material.

1. **Results:** Development of crimping technology for Tencel fiber was addressed by Courtaulds. Preliminary samples of wet and dry crimped Tencel tow were provided for PM evaluation. Courtaulds is attempting to refine crimping techniques and supply PM with sample quantities suitable for rodmaking and filtration evaluations.

2. **Plans:** Obtain additional tow samples from Courtaulds. Produce and evaluate filters. Assess Courtaulds' feasibility of commercialization Tencel tow. Determine whether costs and benefits justify continued development efforts.

3. **Contributors:** D. Laslie, K. Newman, N. Gautam, W. Edwards III, P. Gauvin

**B. Strategy:** Ventilation Position Optimization

1. **Results:** Computer designs of Lights and Ultra Lights products were utilized to predict tow weight savings opportunities by moving the vent rows toward the tobacco column. Merit UL KS control and test models were produced in Semiworks with vent rows at 12mm and 19mm, respectively, from the mouth end. Analytical results on the cigarettes showed equal tar and puff count at an

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acceptable total RTD with a reduced filter RTD on the test model. The data compared favorably with the design predictions. The family of PM discount products was used to prepare a cost savings analysis since this group has many packings which use the same filter. Tow cost savings on the various Lights and Ultra Lights KS and 100's specifications can range from 2 to 8% on the discount group, with an annual tow savings potential between $300,000 and $650,000 at current volume projections.

2. **Plans:** Produce additional models of Lights and Ultra Lights KS and 100's products to define optimum filter specifications and vent row locations. Conduct analytical, physical, and subjective evaluations. Identify product and logistical issues which need addressed.

3. **Contributors:** D. Laslie, K. Newman

C. **Strategy:** High Efficiency Carbon Filters/Low DPF Tow

1. **Results:** Capability evaluations of Eastman's 1.2/30,000 and 1.2/35,000 with and without PICA RC 328 carbon additive were conducted. Filters were submitted to CTSD for filtration efficiency analysis. Eastman was requested to provide samples of 1.4/35,000 and 1.4/41,000 materials. One bale of each was received and filter samples with carbon were made to Merit Ultra Lights – Japan (4mg) specifications.

2. **Plans:** Evaluate consumer response to low DPF tow on Merit – Japan carbon filtered cigarettes. Continue to characterize filters made from low dpf materials to replace carbon–on–paper filters.

D. **Strategy:** Heterofil and Alternative Fiber Development with Celanese

1. **Results:** Researchers at Hoechst Celanese recalculated data from earlier selective filtration screening studies. Ethylene glycol was used as an internal standard. This eliminated systematic errors encountered when water analyses were used to calculate the gram amount of organics present. Hoechst/Celanese continues to generate raw data on the selective filtration screening apparatus. Sixteen polymers have been tested at this point in the program.

2. **Plans:** New analytical data handling procedures presented by Hoechst Celanese research personnel will be critiqued by PM. Problems related to burning off cross linked starch sizing on glass fiber blanks will be investigated. Philip Morris R&D will assist in defining surface physical and chemistry changes caused by heat treating the glass fibers.

3. **Contributors:** A. Finley, J. Hearn, P. Gauvin

E. **Strategy:** Provide support to the Filter Optimization Program.

1. **Results:** Tow cost savings proposals were solicited from Eastman by PM Purchasing. A working team composed of R&D, Technical Services, Operations

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Services, Engineering, and Purchasing was formed to evaluate the information generated by Eastman. Filter Technology participated in the formulation of test plans to evaluate the different tow items being considered and provided input related to pertinent analytical and subjective testing. Eastman's proposal entails the conversion of the major filter tow materials currently used by PM to three new tow items: 3.5/30,000, 2.7/30,000, and 2.0/32,000.

2. **Plans:** Operations Services will produce capability curves for the new tow items as well as verify the curves 3.9/30,000 and 3.3/33,000. Filter Technology will continue to be an active participant in the Filter Optimization Program by monitoring tow capability data, providing physical testing, and providing direction related to appropriate brands for implementation of this program.

3. **Contributors:** J. Hearn, K. Newman

II. **Objective:** Define and apply the benefits of nonwoven web materials to new/unique filter products to affect filtration efficiency, degradability and filter wrappers functionality.

A. **Strategy:** Evaluate Hollingsworth & Vose laminated web materials.

1. **Results:** Based on earlier results on high efficiency cellulose webs with meltblown polypropylene, additional webs were produced by H&V using meltblown polyester as the laminate material in an attempt to address subjective concerns.

2. **Plans:** Produce filters from the polyester laminate material. Evaluate filter performance and identify cost/benefits.

3. **Contributors:** D. Laslie, K. Newman, N. Gautam, W. Edwards, III, P. Gauvin

B. **Strategy:** Evaluate Tencel web.

1. **Results:** A series of ten hydroentangled Tencel webs was produced on DuPont's "Sontara" process under various process conditions to maximize filtration efficiency performance. Rodmaking trials and filter testing were performed on each web. One model, a wet laid Tencel paper phase laminated to the hydroentangled web, exhibited the highest filtration efficiency (~4% higher than Tela paper). A sample of the Tencel paper used for this model was received for testing. Twelve samples from this study were evaluated for fiber shape, fibrillation, fiber orientation and fiber crimp.

2. **Plans:** Determine filtration efficiency performance of wet laid Tencel paper. Consult with Courtaulds & DuPont concerning additional trials which are indicated. Identify cost/benefits of Tencel web.

3. **Contributors:** D. Laslie, K. Newman, N. Gautam, W. Edwards, III, P. Gauvin

C. **Strategy:** Evaluate Heat Seal Wrappers

1. **Results:** Kimberly–Clark was asked to evaluate the plugwrap requirements for the VAMP high speed combiner. A visit to Hauni was made with Kimberly–Clark

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personnel to demonstrate the machine capability and current plugwrap performance. Kimberly–Clark will perform basic investigations to analyze paper and hot melt components of the wrapper. A preheated bar used by Hauni in their evaluations was supplied to Kimberly–Clark.

2. **Plans:** Determine results from Kimberly–Clark trials and assist them in developing high speed heat sealable plugwrap. Field test developed materials on VAMP combiner.

3. **Contributors:** G. Patron

D. **Strategy:** Develop Intermediate Porosity Wrap

1. **Results:** At the request of Operations Services, PM Purchasing department requested Kimberly–Clark to provide PM with plug wrap materials with targeted porosity between current 45M1 and 260M4T. The intermediate porosity materials was requested to help in the production of Virginia Slims Lights, GCC and Japan brands. Plug wrap materials with porosities in the 9500 to 14000 Coresta range should meet the design criteria. Kimberly–Clark is currently evaluating a 9500 Coresta plugwrap and will ship it to R&D completion of their evaluations.

2. **Plans:** Evaluate Kimberly–Clark's 9500 Coresta plugwrap to determine product and process performance.

3. **Contributors:** G. Patron

III. **Objective:** Develop and apply relevant additive technologies to provide functional improvements to delivered smokestreams.

A. **Strategy:** Investigate Dual PZ Booth for Menthol Addition

1. **Results:** A twelve week aging study was completed with Marlboro Lights Menthol test models made by applying a solution consisting of 27.5% menthol, 67.5% triacetin and 5% alcohol. A control was also made using conventional MOF methods at an equivalent menthol rate. CTSD analysis during the 12 week period showed total menthol delivery for the test models to be approximately 15% to 18% below the design value. The lower menthol level was perceived during subjective smoking of 5 week old models. Analytically, the menthol delivery of the test models stored in the laboratory after 12 weeks of aging was about 19% lower than the control.

2. **Plans:** A final modeling study using a dual PZ booth arrangement will be undertaken by splitting the loading point of menthol per cigarette, adding 50% menthol to the filter and the other 50% via MOF. Requests to make filter and cigarettes in Semiworks were submitted. Cigarettes will be analytically, physically and subjectively analyzed.

3. **Contributor:** G. Patron

IV. **Objective:** Characterize and apply novel filters having unique constructions; collaborate with external filter suppliers to asses new technologies.

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A. **Strategy:** Evaluate PCC filter (Merit Ultima) without core plugwrap

1. **Results:** PCC filters without core plugwrap were supplied by AFC for comparison testing against the standard Merit Ultima PCC filter. Control and test cigarettes produced in Semiworks exhibited comparable analytical performance with unventilated filtration efficiency in each case measuring 70%.

2. **Plans:** Conduct subjective testing to achieve parity. Evaluate long term process capability to ensure continued product performance.

3. **Contributors:** D. Laslie, K. Newman, D. Atkinson–Ballos

B. **Strategy:** Evaluate AFC's "Multi–Balanced Flow" Filter (MBF).

1. **Results:** Two filter specifications were prepared to examine the performance of the MBF low RTD/high efficiency mono acetate filter system, which was designed to deliver ~11mg tar at 0% ventilation. Samples were ordered for product testing.

2. **Plans:** Make prototypes in Semiworks at 6 & 11mg tar. Evaluate product performance, cost and benefits.

3. **Contributors:** D. Laslie, K. Newman

V. **Objective:** Support product development with applied filter product and process investigations.

A. **Strategy:** Develop a filter system for a 4mg Merit – Japan product.

1. **Results:** A carbon on paper/cellulose acetate dual filter made by Filtrona International Limited (FIL) was tested and is being purchased for this product. Specifications were supplied to American Filtrona and Baumgartner to evaluate their carbon on paper processes. Concurrently, models with carbon on tow/cellulose acetate dual filters are undergoing comparison testing against the Filtrona International Limited filter.

2. **Plans:** Complete dual acetate filter testing. Evaluate/qualify American Filtrona or Baumgartner as an alternate supplier of the FIL–type filter.

3. **Contributors:** D. Laslie, K. Newman, R. Tierney

B. **Strategy:** Develop a filter system for a Lark Ultra Lights 4mg product.

1. **Results:** Filter specifications were prepared and issued to Baumgartner for sample production of paper–carbon–acetate plug–space–plug filters. These filters were received, tested, and used to produce cigarettes for consumer testing.

2. **Plans:** Evaluate consumer–based filter/product performance. Refine specifications as needed. Qualify supplier processes.

3. **Contributors:** D. Laslie, K. Newman, R. Lambert

C. **Strategy:** Develop and support pin perforation technology.

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1. **Results:** Participated in Pin Perforation System (PPS) development by providing technical resources for the evaluation of ventilation and RTD data from Parliament filters produced on prototype PPS equipment. Extended testing of a production PPS machine was conducted in May. Samples generated are currently being tested. Filters were collected for aging testing (warehouse and accelerated conditions) and for determination of perforation/tipping paper interactions. The goal of these analyses is to determine an appropriate means of measuring the physical attributes of filters perforated by this process and to provide specifications and tolerances from which cigarettes can be manufactured.

2. **Plans:** Initiate aging studies to determine effects on filter physical properties. Coordinate with Operations Services to determine filter/tipping paper interactions. Develop appropriate methodologies for measuring physical attributes of filters perforated by this process. Develop specifications and tolerances for the perforated product.

3. **Contributors:** J. Hearn, K. Newman, D. Hayes

**D. Strategy:** Computer Modelling Support

1. **Results:** Seven Lark Mild cigarette models were produced in Semiworks. Puff by puff gas phase analyses were performed on cigarettes smoked in vertical and in horizontal positions. Cigarettes were selected to an RTD and ventilation targets. Data from CTSD and vertical and horizontal RTD measurements were used by Physical Research to calculate carbon adsorption and related values used in the computer models. Semiworks also produced PM Lights Regular cigarette models at 6 carbon loading levels.

2. **Plans:** PM Lights cigarettes will be held in laboratory conditions for two weeks after which time each model measured for RTD then selected to the mean RTD and ventilation and submitted to CTSD for puff by puff gas phase data.

**E. Strategy:** Packaging Development

1. **Results:** Filter Technology participated as an R&D representative on the Engineering Packaging Innovation Team. Currently two packaging studies are scheduled; the Aluminum Pack study (Aug. 23), and the Booklet Pack study (June 15). Aluminum packs with and without all white graphics were completed. Packs for the Booklet study are currently being hand assembled.

2. **Plans:** Continue to provide support in the form of conceptualization and mock–up fabrication. Provide packaging mock–ups to PED and NY Marketing for Consumer Research testing in second or third quarter of this year. Continue to monitor innovative packaging materials/concepts available in the literature and through trade shows and other professional contacts.

3. **Contributors:** J. Hearn, R. Newsome, Z. Washington, A. Gergely

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**PROGRAM NAME** : R&D Product Technologies – Packaging Technology
**PROGRAM COORD.** : R. Cox/C. Kroustalis
**WRITTEN BY** : C. S. Kroustalis
**PERIOD COVERED** : Second Quarter, 1993

**I. Objective:** To qualify an offset printing system for use on promotional items and low volume or price value brands.

**A. Strategy:** Evaluate the feasibility of using low odor UV printing inks.

1. **Results:** Experimental press samples printed with varying levels and coverages of ink and lacquer indicated no significant subjective differences. This press trial confirms the findings of the laboratory test. Experimental press samples which were intentionally either uncured, undercured or overcured were judged as subjectively unacceptable. Purge and trap/GC/MS analysis indicated quantitative differences between undercured samples and controls.

2. **Plans:** Complete analytical evaluations of the undercured and overcured samples and determine subjective thresholds which relate to analytical quantitative measurements. Print additional test samples to better characterize the system and develop printing specifications.

3. **Contributors:** R. Dunaway, E. Gruca, N. Jensen, C. Keene, R. Kinser, C. Kroustalis, J. Lyons–Hart, B. Mait, J. Naworal, K. Podraza, J. Stargardt, T. Sumpter, E. Thomas, P. Thomas, J. Tindall, G. Vilcins and FTD Packaging Panel.

**II. Objective:** To qualify a waterborne ink system for use on printed packaging materials for fast flow inventory and vendor emissions compliance.

**A. Strategy:** Evaluate the feasibility of using waterborne inks in PM primary packaging materials.

1. **Results:** Test Lark KS FTB blanks printed with waterborne red and verge inks were found to be subjectively acceptable. Test Marlboro KS SP labels and Marlboro LS FTB blanks printed with waterborne red ink and waterborne lacquer were also subjectively acceptable. Hazing has been a problem with all print trials. Mechanical means to minimize hazing are being investigated. Additionally, the ink supplier (ICI) has been asked to recommend possible formulation changes to address this problem.

2. **Plans:** Coordinate activities with Purchasing Technical Services for additional press trial evaluations. Determine whether printed materials can be used off–press.

3. **Contributors:** R. Dunaway, E. Gruca, B. Mait, J. Stargardt, P. Thomas and FTD Packaging Panel.

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III. **Objective:** To determine the impact of overwrapping cigarette packs with alternate film materials.

A. **Strategy:** Overwrap cigarette packs with up to four layers of standard film and determine OV's and subjective results after storage in ambient, cold and desert room conditions for six weeks.

1. **Results:** Oven volatile data indicate a 50% improvement in moisture retention for desert room samples with two layers of film. Three and four layers of film indicated only a slight improvement in moisture retention. No significant OV differences were found under ambient and cold storage conditions.

2. **Plans:** Evaluate subjective results and report findings to Quality Engineering.

3. **Contributors:** B. Mait, P. Thomas, V. Willis and FTD Panel.

IV. **Objective:** Provide support for the qualification of new packaging materials used in new brands, line extensions, graphics changes and promotional programs.

A. **Strategy:** Evaluate new packaging materials for subjective acceptability and make recommendations for use.

1. **Results:** The following items were evaluated and qualified for use:

Virginia Slims Booklet Pack pressure sensitive sticker.
Marlboro Adventure Team 20/40 poly band.
Pearlescent white ink for Merit graphics redesign.
Basic KS SP carton on 11–point board.
Marlboro Adventure Team 20/40 sleeve.
Alpine T–shirt carton insert.
Parliament 100's FTB on 10–point board.
Merit KS FTB on 11–point board.
Parliament 20/40 sleeve.
Alpine 100's and KS 20/40 sleeve.
Parliament carton insert.
Parliament beach towel coupon (three–layer).

2. **Plans:** Continue providing support for the qualification of new packaging materials as needed.

3. **Contributors:** R. Dunaway, B. Mait, P. Thomas, Purchasing Technical Services, FTD Analytical and FTD Packaging Panel.

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**PROGRAM NAME** : R&D Product Technologies – Tobacco Technology
**PROGRAM COORD.** : W. P. Hempfling
**WRITTEN BY** : W. P. Hempfling
**PERIOD COVERED** : Second Quarter, 1993

**Coordinator Summary:** Field transplantations have been completed for the 1993 Regional Small Plot Tests and Regional Farm Tests.

Determination of the alkaloid contents of transgenically modified (PMT constructs) tobacco plants has begun. One plant (of seven so far examined) has been found to contain half of the nicotine of control plants.

The feasibility of applying Polymerase Chain Reaction to amplify a portion of the PMT gene in air–cured and flue–cured tobacco has been demonstrated. It is therefore reasonable to consider that cured tobacco produced from transgenically modified plants could be identified.

Development of methods to distinguish among different populations of cigarette beetles (CBs) is under way. These include restriction mapping of mitochondrial DNA, protein profiling by two–dimensional electrophoresis and characterization of chromosome structure.

The aberrant response to methoprene of feral CBs from Commerce Road Warehouse No. 44 has been shown to persist even after several generations were reared on methoprene–free tobacco.

The insect growth regulators kinoprene and hydroprene (structurally related to methoprene) were tested to determine their efficacy for CB control. Kinoprene does not bring about significant mortality of the CB (laboratory colony or feral – Commerce Road Warehouse No. 44) at concentrations up to 100 ppm. Hydroprene application results in 50% mortality of lab colony CBs at 4.0 ppm, and of the feral CBs at 6.8 ppm. Kinoprene (at least) is not recommended for use as a CB control agent.

The feasibility of using a centrifugal method as a predictive means of determining the filling value of tobacco in the cigarette is being examined.

## TOBACCO AGRONOMY

**I. Objective:** Participate in the Cooperative Tobacco Variety Evaluation Program.

**A. Strategy:** Conduct cooperative subjective and chemical evaluations of submitted flue–cured and burley tobacco samples. Communicate results to Variety Evaluation Committees and other organizations as required.

**1. Results:** Field transplanting operations for the 1993 Regional Small Plot Tests have been completed at Tobacco Research Stations in each state. Field transplantations have also been completed for the 1993 Regional Farm Tests at cooperating farms. This spring's unusually wet and cool conditions have caused some delays in field preparations, and the late winter storm resulted in the loss of some greenhouses and plants in certain locations.

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At the request of Dr. B. Miller, Greeneville Tennessee Tobacco Experiment Station, cigarettes were prepared from two experimental burley tobaccos possessing secreting (GR–139 S) and non–secreting (GR–139 NS) trichomes and evaluated by the Leaf Department Smoking Panels. The two samples were judged to differ in subjective response, with GR–139 NS preferred. Results were communicated to Dr. Miller.

The analyses (total alkaloids, total reducing substances and total nitrogen) of 153 tobacco samples from the 1992 test conducted by the South Carolina Pee Dee Experiment Station have been completed. Results were reported to J. Rideout and D. Gooden of Clemson University.

2. **Plans:** Continue participation in industry cooperative efforts.

3. **Contributors:** R. Bass.

4. **References:** Bass, R. Notebook No. 8999.

II. **Objective:** Produce tobacco and other botanical materials for use by PM research.

A. **Strategy:** Operate the PM Greenhouse Facility for the production of plant materials in support of various activities. Supply the products to requestors.

1. **Results:** Transgenic tobacco plant Groups No. 1 – 13 have been provided to Tobacco Biochemistry as requested. Plants of Groups No. 14 and 15 have been bagged for seed production.

Bittersweet plants (Solanum dulcamara) requested by PM Europe continue under culture, showing good growth. Samples have been provided to Analytical Research Division. At the request of Mr. C. Owens a visit was made to the tobacco plot at Jamestown VA to provide tobacco plants for the filming of the PM presentation "Tobacco Seed to Pack". A follow–up visit to help maintain the plot revealed opportunities to afford the public factual information about the importance of tobacco to the colonial economy. This was suggested to appropriate Jamestown personnel, and PM Community Relations was so informed.

2. **Plans:** Continue operations and maintenance of the Greenhouse, and requested support activities.

3. **Contributors:** R. Bass, G. West.

4. **References:** Bass, R. PM Notebook No. 8999; West, G. PM Notebook No. 8559.

## TOBACCO BIOCHEMISTRY

III. **Objective:** Complete work necessary to support patent position concerning biochemical modification of tobacco to achieve reduction of alkaloid content (PMT–based modification).

A. **Strategy:** Express the sense and antisense of the DNA sequences encoding PMT in tobacco plants.

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1. **Results:** Information has been obtained about the alkaloid contents of seven transgenic plants containing the PMT–sense construct, seven plants containing the PMT–antisense construct, and eight control plants. One plant transformed with the sense construct manifested a reduction (53%) of nicotine and a doubling of nornicotine contents as compared to controls. Other minor alkaloids were not different from those of controls.

2. **Plans:** Determine alkaloid contents in the remainder of the transgenic and control plants.

3. **Contributors:** R. Forte, M. Shulleeta, G. West

4. **References:** Shulleeta, M. PM Notebook No. 9132.

**IV. Objective:** Investigate methods for identification of and determining differences in populations of cigarette beetles (CBs).

**A. Strategy:** Isolate and characterize mitochondrial DNA (mtDNA) from selected CB populations.

1. **Results:** A procedure for the isolation and subsequent digestion of mtDNA from different populations of CBs has been developed. It has been used to examine three different populations of CBs (laboratory colony, Commerce Road warehouse isolates, and mutant Black Body beetles). To date restriction digestion patterns using the restriction enzymes BglII, XbaI, XhoI, PstI and BglII have not revealed differences in DNA fragments.

2. **Plans:** Continue development of restriction maps of CB mtDNA. Determine the feasibility of using the method of Random Amplified Polymorphic DNA (RAPD) to identify differences in mtDNA and nuclear genomic DNA of CBs.

3. **Contributors:** D. Ayers, T. Burruss, D. Coar, T. Michalik.

4. **References:** Ayers, D. PM Notebook No. 9236; Michalik, T. PM Notebook No. 8916.

**B. Strategy:** Characterize protein profiles from different populations of CBs by electrophoretic means.

1. **Results:** Introductory work using single dimension electrophoresis of CB larval extracts has demonstrated the necessity of the greater resolution of individual proteins provided by 2D electrophoresis.

2. **Plans:** Obtain protein profiles of adult and larval CB extracts using the Daiichi 2D electrophoresis apparatus.

3. **Contributors:** T. Burruss, M. Krauss, M. Shulleeta.

4. **References:** Shulleeta, M. PM Notebook No. 9132.

**C. Strategy:** Determine the feasibility of employing chromosomal analysis to differentiate among CB populations.



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